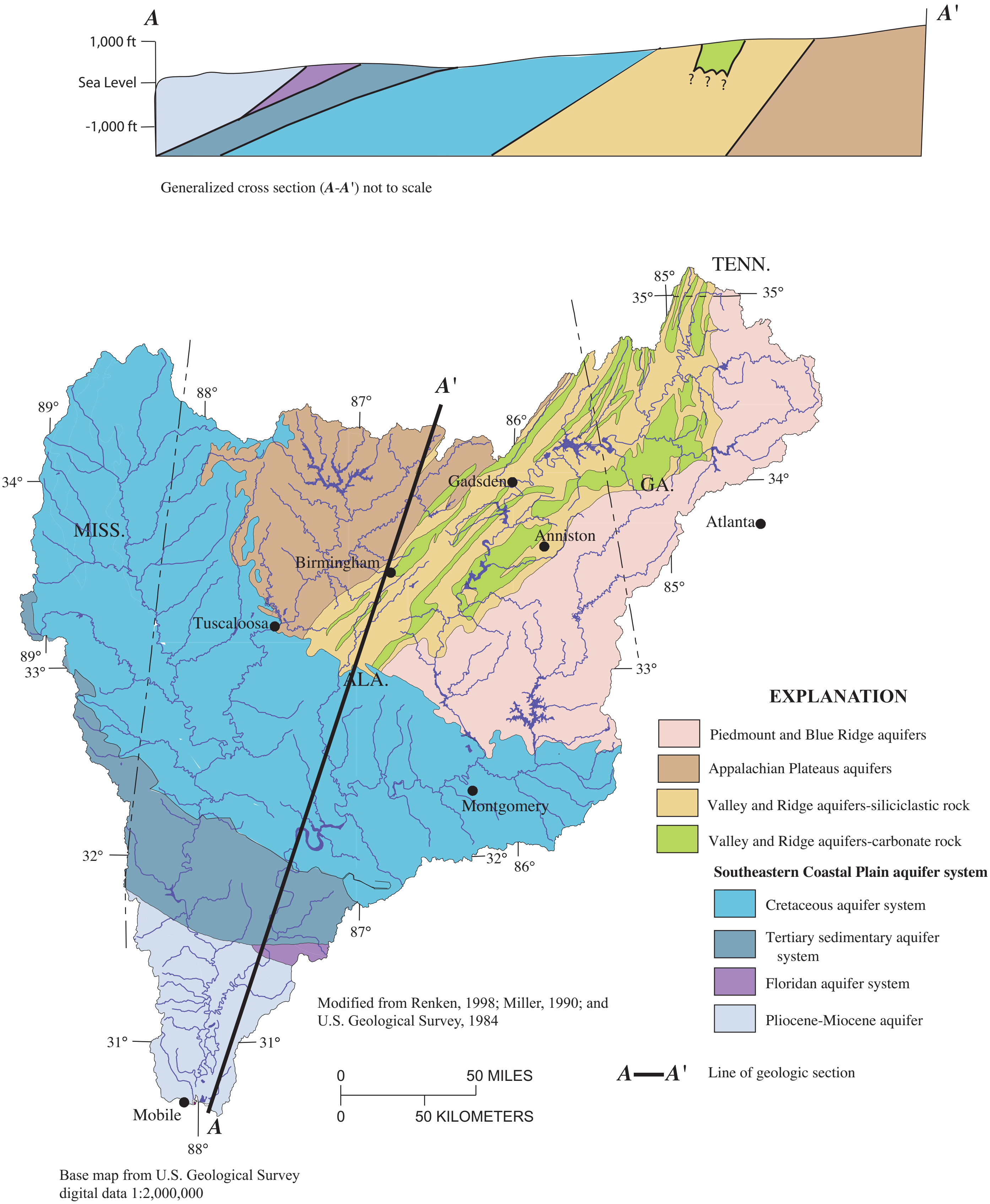


Figure 12. Major aquifer systems and generalized section in the Mobile River Basin.

Table 2. Generalized major aquifers in the Mobile River Basin

[From: U.S. Geological Survey, 1984; Mooty and Kidd, 1997; Robinson and others, 1997; Kidd and others, 1997; and Journey and Atkins, 1997.]

Major aquifer	Lithology	Geologic age	Aquifer type
Southeastern Coastal Plain aquifer system Cretaceous aquifer system	Sand and gravel of the Gordo, Coker, Eutaw, and Ripley Formations.	Upper Cretaceous	Porous media
Tertiary sedimentary aquifer system	Sand, clay, gravely sand	Paleocene to Eocene	Porous media
Floridan aquifer system	Limestone	Eocene and Oligocene	Solution conduit
Pliocene-Miocene aquifer	Sand and gravel beds of Citronelle Formation.	Pliocene	Porous media
	Undifferentiated deposits of Miocene Series.	Miocene	
Valley and Ridge aquifers	Limestone, dolomite, chert	Paleozoic	Solution conduit
	Sandstone, shale, siltstone	Paleozoic	Fracture conduit
	Sand and gravel, sandstone, sandy chalk and clay.	Cenozoic	Porous media
Appalachian Plateaus aquifers	Limestone, dolomite, chert	Paleozoic	Solution conduit
	Sandstone, shale, siltstone	Paleozoic	Fracture conduit
Piedmont and Blue Ridge aquifers	Quartzite, slate, gneiss, schist, marble, phyllite, and granite.	Precambrian to Paleozoic	Fracture conduit
	Regolith, soil, alluvium, colluvium, and saprolite.	Various ages	Porous media

coast, horizontal flow is blocked either by saltwater or by fine-grained sediments that reduce the permeability of the aquifer.

The Cretaceous aquifer system (table 2) is the basal aquifer of the Southeastern Coastal Plain aquifer system and is the most widespread of the regional aquifers in the system. The Cretaceous aquifer system consists of sand beds in the Providence Sand and the Ripley and Eutaw Formations and the Tuscaloosa Group, which includes the Gordo and Coker Formations (U.S. Geological Survey, 1984). The aquifers in this system are also known as the Chattahoochee River aquifer and the Black Warrior River aquifer (Miller, 1990). The confining units consist of chalk and clay beds in the western part of the Mobile River Basin and marine clay beds in the eastern part of the basin (Davis, 1988).

The Tertiary sedimentary aquifer system (table 2) is a thick sequence of sand with minor sandstone and gravel and a few limestone beds. The sediments composing the aquifer range in age from Paleocene to late Eocene and were deposited mostly in marine environments. The aquifer is equivalent to the Mississippi embayment aquifer system to the west and southwest and to the Pearl River aquifer in Alabama. The Tertiary sedimentary aquifer system and the Floridan aquifer system are hydraulically connected. Locally, the upper part of the Tertiary sedimentary aquifer system is known as the Lisbon aquifer and the lower part as the Nanafalia-Clayton aquifer.

The Floridan aquifer system (table 2) consists of limestone of Eocene and Oligocene age. The solution-conduit aquifer occurs in sandy carbonate rocks that have little primary porosity or permeability. Water moves through secondary porosity features, such as solution-enlarged fractures and bedding planes that form a system of interconnected conduits (Kidd and others, 1997). The Floridan aquifer system is a minor contributor of ground water in the Mobile River Basin, but is an important, high yielding aquifer in southeastern Alabama, Georgia, and Florida.

The Pliocene-Miocene aquifer (table 2) is present in the southern part of the Mobile River Basin in southwestern Alabama (fig. 12). This aquifer, the youngest regional aquifer in the Southeastern Coastal Plain aquifer system, consists of sand and gravel beds in the Citronelle Formation of Pliocene age and sand beds in the undifferentiated Miocene Series (U.S. Geological Survey, 1984). The aquifer is a source of domestic and public water supplies over extensive areas of southern Alabama (Kidd and others, 1997). The Citronelle Formation is a water-table aquifer with discontinuous sand beds controlling water levels locally (Davis, 1988). The Pliocene-Miocene aquifer is also known as the Chickasawhay River aquifer and is considered part of the Coastal Lowlands aquifer system.

Valley and Ridge Aquifers

Aquifers in the Valley and Ridge Physiographic Province consist of permeable geologic formations within folded and faulted Paleozoic sedimentary rocks. The rocks range in age from early to late Paleozoic. Most of the Valley and Ridge aquifers consist of limestone or dolomite. The carbonate rocks are productive aquifers primarily because of the solution openings in the easily dissolved limestone and dolomite. These openings, which originate as bedding planes and joints in the carbonate rocks, are enlarged by percolating slightly acidic ground water, and become linked as a series of conduits that rapidly transmit large volumes of ground water through the carbonate rocks. The easily eroded carbonate rocks form wide valley floors, which are favorable areas for recharge. Other aquifers consist of sandstone formations but yield less water than do the carbonate rocks. Much of the water from the sandstone is obtained from fractures (Mooty and Kidd, 1997). Regolith, which acts as a porous media aquifer above the carbonate-rock aquifers, contains chert rubble of Cenozoic age that stores and transmits water slowly to the underlying fractured-rock aquifer (Robinson and others, 1997).

Appalachian Plateaus Aquifers

Aquifers in the Cumberland Plateau section of the Appalachian Plateaus Physiographic Province consist of permeable stratigraphic units within flat-lying sedimentary rocks of Paleozoic age. Rocks comprising the aquifers are mostly sandstone, conglomerate, and coal of Pennsylvanian age, but in places include beds of limestone and chert of Mississippian age. A thick sequence of shale, sandstone, and coal overlies Mississippian limestone. Sandstone beds yield small volumes of water, but supply water to a large number of domestic wells because sandstone caps most of the upland plateaus in the Mobile River Basin (Stricklin, 1989).

Most of the water in both limestone and sandstone is present in fractures. In the limestone, the circulation of slightly acidic ground water has enlarged fractures by dissolution of the carbonate rock. Where vertical fractures extend to the land surface, the enlarged solution conduits may become completely or partially filled with sediment transported into them by surface streams. Where unfilled, these solution openings convey large volumes of water (Miller, 1990).

Flow in the Appalachian Plateaus aquifers is affected primarily by topography, structure, and the development of solution openings in the rocks. Recharge to the aquifers is by precipitation on the flat, mesa-like plateau tops. Water then percolates down through the interbedded Pennsylvanian rocks, primarily along steeply inclined joints and fractures. In places, shale beds retard the vertical flow and some water flows laterally along bedding planes, mostly in sandstone and conglomerate beds, and discharges as spring flow along steep valley walls. Some of the water migrates down across the thick shale confining unit into the underlying limestone aquifer (Miller, 1990).

Piedmont and Blue Ridge Aquifers

The crystalline-rock aquifers that underlie the Piedmont and Blue Ridge Physiographic Provinces in the northeastern part of the Mobile River Basin are collectively called Piedmont and Blue Ridge aquifers (Miller, 1990). Although there are considerable differences in the mineralogy and texture of the rocks composing the Piedmont and Blue Ridge aquifers, the overall hydraulic characteristics of the aquifers are similar. Locally, however, the occurrence and availability of ground water varies greatly because of the complex variability in rock type. Such variability of rock type makes describing regional ground-water flow impractical.

The Piedmont and Blue Ridge aquifers consist of crystalline bedrock overlain by regolith (unconsolidated material). Included in the regolith are: saprolite, which is a layer of earthy, decomposed rock developed by weathering of the bedrock; alluvium, which is mainly confined to stream valleys; colluvium, which consists of material transported downslope by weathering; and soil that develops on top of these layers. Because the crystalline rocks are formed under intense heat and pressure, they have few primary pore spaces, and the porosity and permeability of the unweathered and unfractured bedrock are extremely low. This does not mean, however, that these rocks will not yield water. Ground water can be obtained from the regolith and fractures in the rock. Locally, where the crystalline rocks consist of marble, the dissolving action of slightly acidic ground water has created solution openings that yield large volumes of water (Miller, 1990).

Water in the rocks of the Piedmont and Blue Ridge aquifers generally is unconfined. Locally, artesian conditions exist where wells penetrate deeply buried fractures that are hydraulically connected to recharge areas of higher altitudes or in places where the regolith is clayey and forms a confining unit (Kidd, 1989). Water enters the ground in recharge areas, which include all the land surface except the lower parts of valleys, and then percolates vertically downward through the unsaturated zone. Water reaches the saturated zone (water table) and moves laterally to points of discharge. Water discharges as springs, seeps, base flow to streams, and seepage to lakes. The water table is a subdued replica of the surface topography. The depth to the water table varies, depending mainly on topography and to a lesser extent on rainfall (Robinson and others, 1997).

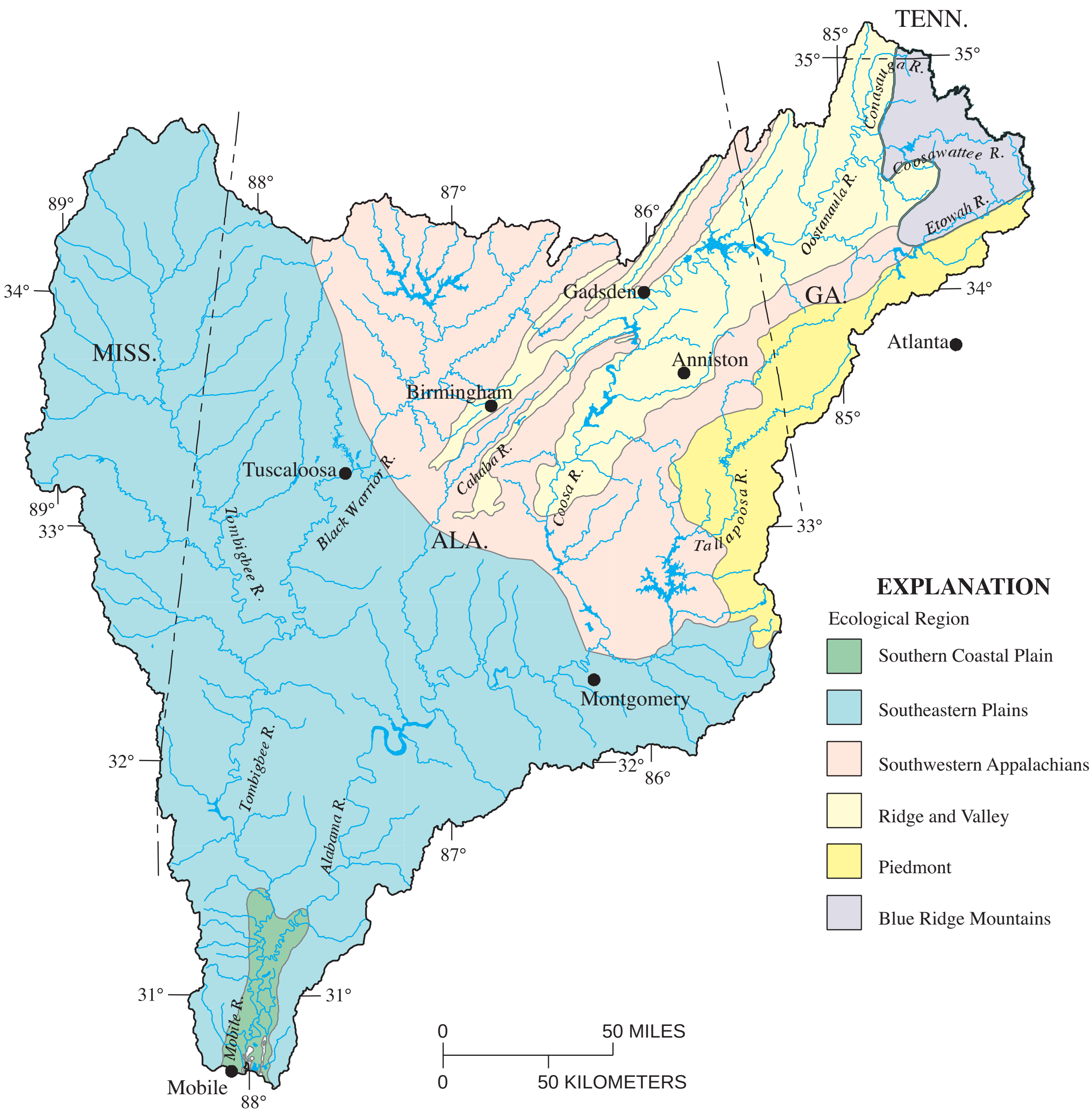
Ecoregions

Areas where ecological systems are generally similar are identified as ecoregions. Ecoregions are based on coincident patterns of natural factors such as geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology (Omernik, 1987; Griffith and others, 1998). Ecoregions can provide a framework for assessing ecological conditions with respect to the natural environmental setting.

In an ecoregion hierarchy established by Omernik (1987), a Roman numeral classification scheme was adopted to prevent confusion caused by terminology associated with the different hierarchical levels. Level I divides the North American continent into 15 major ecological regions. Level II subdivides the 15 major ecological regions into 52 classes, and Level III further subdivides the 52 classes into 120 classes. The U.S. Environmental Protection Agency (U.S. EPA) has identified the following six Level III ecoregions (fig. 13) within the Mobile River Basin: (1) Southern Coastal Plain ecoregion lies within the deltaic part of the Alluvial-Deltaic Plain Physiographic district; (2) Southeastern Plains ecoregion lies within the remaining Coastal Plain Physiographic Province; (3) Southwestern Appalachians ecoregion is located in the Cumberland Plateau Physiographic Province and extends into the noncarbonate rock (ridges) of the Valley and Ridge Physiographic Province and the western part of the Piedmont Physiographic Province; (4) Ridge and Valley ecoregion includes the carbonate valleys of the Valley and Ridge Physiographic Province; (5) Piedmont ecoregion includes the eastern part of the Piedmont Physiographic Province; and (6) Blue Ridge Mountains ecoregion covers the higher altitude areas of the Piedmont, Valley and Ridge, and Blue Ridge Physiographic Provinces in the northeastern part of the basin (U.S. Environmental Protection Agency, 2000). The degree of overlap between the ecoregions and the physiography and geology of the basin indicates that the natural variations in the physiography and geology are reflected in the ecological systems.

The Southern Coastal Plain extends from South Carolina and Georgia, through much of central Florida, and along the Gulf coast lowlands of the Florida Panhandle, Alabama, and Mississippi (Omernik, 1987). In the Mobile River Basin, the ecoregion is drained by the distributaries of the Mobile Delta and freshwater streams which, in turn, drain to Mobile Bay. These meandering, low-gradient, and sandy-bottomed streams flow across flat, swampy plains and bottomlands that characterize the topography in this ecoregion. Surface elevation ranges from sea level to approximately 100 feet above sea level. The Southern Coastal Plain landscape supports forest and woodland areas with some cropland and pasture. Once covered by a forest of beech, sweetgum, southern magnolia, slash pine, loblolly pine, white oak, and laurel oak, land cover in the ecoregion is now mostly longleaf-slash pine forest, oak-gum-cypress forest in some low-lying areas, pasture for beef cattle, and urban areas (Glenn Griffith, U.S. Environmental Protection Agency, written commun., 2000).

The Southeastern Plains ecoregion covers an extensive part of the Mobile River Basin. The landscape is smooth to irregular plains or flatlands separated in some places by curved bands of asymmetrical ridges and rugged hills. Surface elevation ranges from as little as 25 feet above sea level in the southernmost plains to over 400 feet above sea level in the hills. The streams draining this ecoregion are generally low gradient with silty and sandy substrates. Forest and woodland areas are prevalent and are a part of the mosaic of cropland, pasture, and urban areas which dot the landscape. The natural vegetative cover includes oak, hickory, pine, and southern mixed forests. The dominant soils are formed from the weathering of the underlying clastic sediments and are better drained than soils of the Southern Coastal Plain. Soils overlying clayey or chalk deposits, however, are poorly drained.



Base map from U.S. Geological Survey
digital data, 1:2,000,000

Figure 13. Ecological regions of the Mobile River Basin. (Modified from Omernik, 1987.)

The Southwestern Appalachians ecoregion extends from Kentucky to Alabama. These open low mountains contain a mosaic of forest and woodland with some cropland and pasture. The landscape is dominated by plateaus, hills, and mountains and is drained by streams of moderate gradient with cobble, gravel, and bedrock substrates. The surface elevation ranges from about 250 feet above sea level in the southwest to about 1,100 above sea level in the northeast. Oak, hickory, pine, and mixed forest of maple, tuliptree, oak, and linden are the natural forest cover for this area (Omernik, 1987).

The Ridge and Valley ecoregion ranges in elevation from 600 to over 1,600 feet above sea level and is drained by moderate to high-gradient streams with cobble, gravel, and bedrock substrates. As a result of extreme folding and faulting, the roughly parallel ridges and valleys vary in width, height, and geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Springs and caves are numerous. Cropland and pasture are prevalent with some woodland and forest. The dominant vegetative cover is Appalachian oak forest.

The northeast-southwest trending Piedmont ecoregion, considered the nonmountainous part of the old Appalachian Highlands by physiographers, is a transitional area between the mostly mountainous ecoregions of the Appalachians to the northwest and the relatively flat coastal plain to the southeast. The area is underlain by Precambrian and Paleozoic metamorphic and igneous rocks with moderately dissected irregular plains with some hills. Surface elevation ranges from about 500 to 600 feet above sea level to the southwest in Alabama, to 1,500 to 1,700 feet above sea level in Georgia near the foot of the Blue Ridge Mountains. Once largely cultivated, much of this region has reverted to pine and hardwoods. The soils are finer textured and lower in organic matter and nutrients than the soils of the coastal plain regions.

The Blue Ridge Mountains ecoregion extends from southern Pennsylvania to northern Georgia, varying from narrow ridges to hilly plateaus to more massive mountainous areas with high peaks. The Blue Ridge Mountain part of the Mobile River Basin is in the northeasternmost part of the basin. This ecoregion accounts for only a small amount of the entire basin but has distinctive characteristics. The rugged mountains and ridges have surface elevations ranging from about 3,000 to 4,700 feet above sea level and are drained by high-gradient streams with cobble, gravel, and bedrock substrates. The landscape is covered mostly by ungrazed woodlands and forests.

Aquatic Ecology

The diverse aquatic habitats in the Mobile River Basin sustain one of the richest aquatic fauna in North America. The basin's endemic fauna include 40 fishes, 33 mussels, 110 aquatic snails, as well as a variety of turtles, aquatic insects, and crustaceans (U.S. Fish and Wildlife Service, 1998a). However, contaminants and modification of aquatic habitat such as impoundments, channelization, dredging, and mining over the past few decades have resulted in the presumed extinction of at least 15 mussels and 38 aquatic snails (Appendix A). The basin also has 39 species of aquatic animals and plants that are currently protected under the Endangered Species Act of 1973 (U.S. Fish and Wildlife Service, 1986), including 11 fish, 17 mussels, 7 snails, 2 turtles, and 2 plants (Appendix B). A review of other candidate species may substantially increase the number of species listed under the act (U.S. Fish and Wildlife Service, 1998b).

The Endangered Species Act of 1973 was established by the Federal government to protect endangered species. This act groups species in peril into two categories: endangered or threatened. A species is considered endangered when it is in danger of becoming extinct throughout all or a significant portion of its range. A threatened species is likely to become endangered in the near future in all or a significant part of their range (U.S. Fish and Wildlife Service, 1986).

Cultural Factors

Human activities have affected water quality and quantity in the Mobile River Basin. A series of locks and dams on rivers throughout the basin have increased flood control, improved navigation, provided hydroelectric power, and promoted many recreational activities. These dams also have had negative effects on the aquatic ecology of the region. The presence of the dams have resulted in lowered temperatures and dissolved oxygen concentrations in the tailwaters of the dams, thus adversely affecting the natural aquatic population and the distribution of fish. The lakes impounded by these dams now support different arrays of aquatic ecology than would be found in naturally free-flowing rivers. In addition to the physical alterations of the river system, as population growth in the Mobile River Basin has increased, forested and agricultural land use has changed to more urban and industrial applications, resulting in an increase in demand for water and other resources.

Study Unit Stratification

An environmental framework was developed for the Mobile River Basin to isolate the effects of natural and human factors that are thought to be the most important in affecting water quality and quantity. Characterizing this environmental framework is an important element in each study-unit investigation of the NAWQA Program. The environmental framework divides a study unit into several subareas (not necessarily contiguous) that have homogeneous combinations of those natural and human factors believed to be relevant to water quality (Gilliom and others, 1995). This process is called stratification. The identified strata provide a unique spatial framework to be used for (1) conducting a retrospective analysis of water quality, (2) evaluating study priorities and approaches for assessing water-quality conditions, (3) designing the monitoring program, and (4) making comparative assessments of water quality and ecosystems within the Mobile River Basin and among the hydrologic systems across the Nation. Natural factors in the Mobile River Basin include geology, physiography and aquifer systems. Human factors include agricultural land use, mining, forested land use, and urbanization.

The Mobile River Basin was stratified based on the physiography with the Alluvial-Deltaic Plain district of the Coastal Plain Physiographic Province separated into the Deltaic deposits and the Alluvial aquifer (fig. 14). Land and water use in the Mobile River Basin are evaluated based on this stratification. County-level data for agricultural and water-use activities and population distribution were weighted to provide estimates for each strata based on the area of the county within each strata. These weighting approaches may give inaccurate results in areas where the population distribution, water-use, or agricultural activities vary greatly across a county, but the error introduced in this step is not significant for the strata encompassing large areas and multiple counties.

Reservoirs

The surface-water system in the Mobile River Basin is regulated by 36 dams that influence the hydrology of the basin (fig. 8, table 3). Streamflow in the Alabama River is affected by 10 reservoirs and hydroelectric plants upstream in the Coosa River Basin; 4 reservoirs and hydroelectric plants on the Tallapoosa River; and 3 navigational locks and dams on the Alabama River. The Cahaba River, a major tributary to the Alabama River, drains 1,820 square miles in central Alabama and is the largest free-flowing river in the Mobile River Basin. The Cahaba River Basin has only one reservoir, Lake Purdy (table 3), on the Little Cahaba River. The Tombigbee River is affected by 12 navigational locks and dams on the main stem. The Black Warrior River, a main tributary to the Tombigbee River, is affected by four navigational locks and dams and two reservoirs, Lake Tuscaloosa and the Lewis Smith Reservoir (table 3). The Tombigbee River is part of the Tennessee-Tombigbee waterway.

The Tennessee-Tombigbee waterway, a 234-mile navigation channel connecting the Tombigbee River to the Tennessee River, was completed in 1985 and is the largest manmade water-resource project built in the United States. The major features of the waterway are 12 locks and dams, a 12-foot-deep and 280-foot-wide canal, and 234 miles of navigation channels. The 12 locks are used to raise or lower barges and boats a total of 341 feet, the difference in elevation between the two ends of the waterway (The Tennessee Tombigbee Waterway Development Authority, 2001).

Land Use

Based on 1991 land-use data (U.S. Environmental Protection Agency, 1992), about 70 percent of the basin is forested, while agriculture, including livestock, aquaculture, row crops, and pastureland, accounts for about 26 percent of the study unit. Agricultural land use (fig. 15) is concentrated in an area corresponding to the Black Prairie Belt district of the Coastal Plain Physiographic Province. No agricultural activities are associated with the Deltaic deposits due to the prevalence of poorly drained soils. Urban areas account for only 3 percent of the total land use; however, the areal coverage of the metropolitan statistical areas (MSA) may indicate more urban influences.

Agriculture

The primary row crops produced in the Mobile River Basin include corn, soybeans, cotton, wheat, and sorghum. Cultivation of corn is well distributed throughout the Coastal Plain Physiographic Province with the greatest acreage in the Southern Hills and Fall

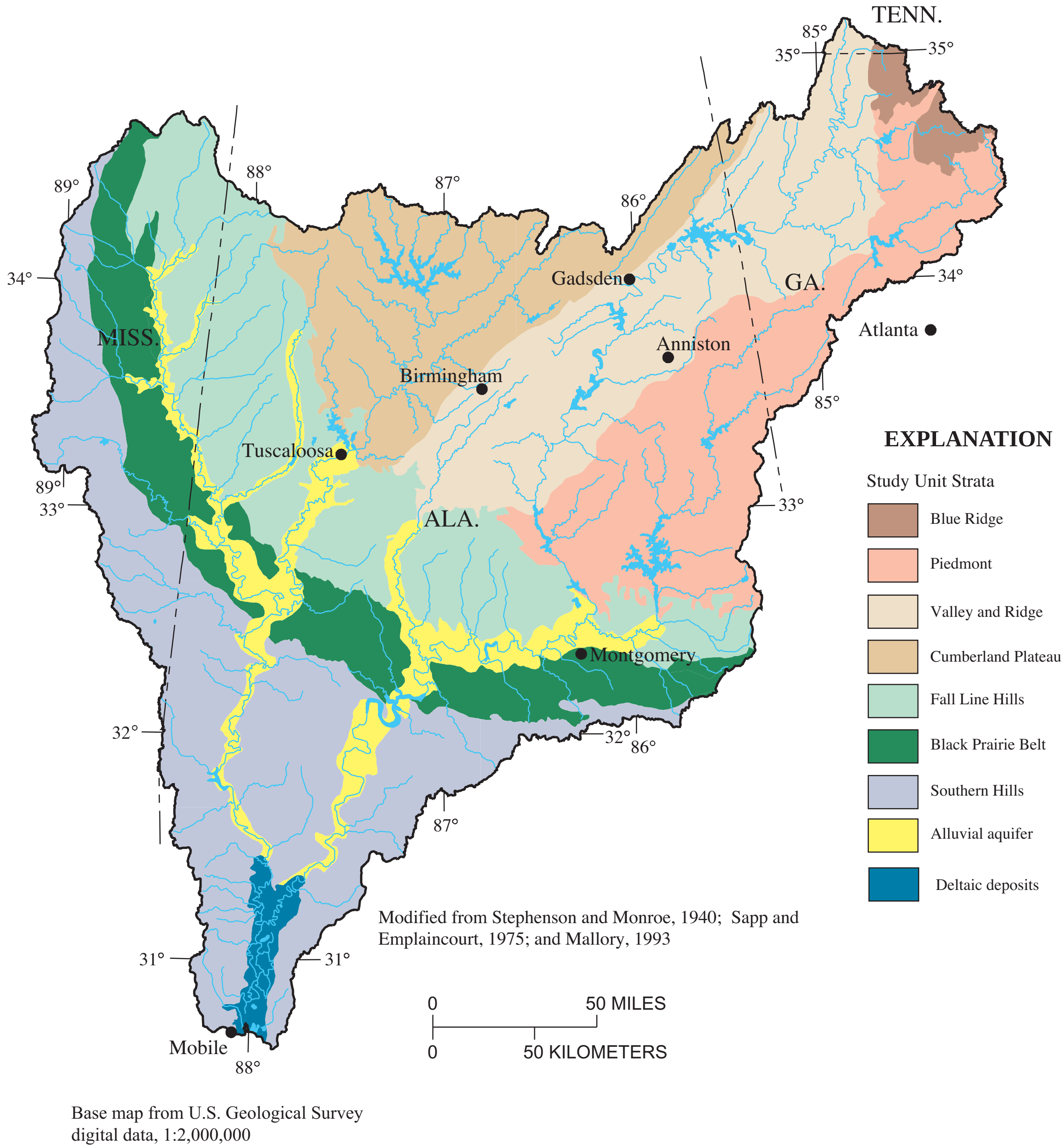


Figure 14. Study unit stratification of the Mobile River Basin.

Table 3. Dams and associated impoundments in the Mobile River Basin

[mi^2, square miles; --, data not available; FC, flood control; N, navigation; P, power; WS, water supply; WQ, water quality; FW, fish and wildlife; R, recreation; USACOE, U.S. Army Corps of Engineers; APC, Alabama Power Company]

No. (see fig. 8)	Name of dam	Associated impound-ment	River	Agency	Date constructed or operational	Princi-pal use	Location	River mile	Total drainage area (mi^2)	Full power or normal pool data	
										Surface area (acres)	Storage capacity (acre-feet)
					Coosa River Subbasin						
1	Carters	Carters Lake	Coosawatte River	USACOE	1974	P, FC, R	Murray County, Ga.	[5]26.8	[4]373	[4]3,220	[1]472,800
2	Carters re-regula-tion	--	Coosawatte River	USACOE	1975	P, FC, R	Murray County, Ga.	[5]25.3	[5]520	--	[1]17,600
3	Allatoona	Allatoona Lake	Etowah River	USACOE	1949	P, FC, R	Bartow County, Ga.	[5]47.0	[4]1,120	[4]19,200	[1]367,000
4	Weiss	Weiss Lake	Coosa River	APC	1961	P, FC, R	Cherokee County, Ala.	[2]226.1	[2]5,270	[4]28,300	[2]360,400
5	H. Neely Henry	H. Neely Henry Reser-voir	Coosa River	APC	1966	P, FC, R	Calhoun County, Ala.	[2]146.8	[2]6,596	[4]11,235	[2]120,850
6	Logan Mar-tin	Logan Martin Reservoir	Coosa River	APC	1964	P, FC, R	St. Clair County, Ala.	[2]98.5	[2]7,743	[4]15,260	[2]273,300
7	Lay	Lay Lake	Coosa River	APC	1914 1968	P, FC	Chilton County, Ala.	[2]51.0	[2]9,053	-- [4]6,700	[2]144,994 [2]262,774
8	Mitchell	Mitchell Lake	Coosa River	APC	1923	P, R	Chilton County, Ala.	[2]36.8	[2]9,778	[4]5,800	[2]172,000
9	Jordan	Jordan Lake	Coosa River	APC	1929	P, R	Elmore County, Ala.	[2]18.9	[2]10,102	[4]4,800	[2]236,200
10	Walter Bouldin	Jordan Lake Diversion	Coosa River	APC	1967	P	Elmore County, Ala.	--	--	[4]920	[4]230,000
					Tallapoosa River Subbasin						
11	Harris	Harris Reser-voir	Tallapoosa River	APC	1982	P, FC, R	Randolph County, Ala.	[2]139.0	[2]1,453	--	--
12	Martin	Lake Martin	Tallapoosa River	APC	1926	P, FC, R	Tallapoosa County, Ala.	[2]60.6	[2]2,984	[4]38,300	[4]250,000
13	Thurlow	Thurlow Res-ervoir	Tallapoosa River	APC	1930	P	Tallapoosa County, Ala.	[6]49.7	[6]3,308	[4]585	[4]11,000
14	Yates	Thurlow Res-ervoir	Tallapoosa River	APC	1928	P, R	Tallapoosa County, Ala.	[6]52.7	[6]3,293	[4]1,920	[4]26,000

Table 3. Dams and associated impoundments in the Mobile River Basin—Continued

No. (see fig. 8)	Name of dam	Associated impound-ment	River	Agency	Date constructed or operational	Princi-pal use	Location	River mile	Total drainage area (mi^2)	Full power or normal pool data	
										Surface area (acres)	Storage capacity (acre-feet)
					Cahaba River Subbasin						
15	Lake Purdy	Lake Purdy	Little Cahaba River	Birming-ham Water Works Board	1911 ([4]1964)	WS, R, FC	Jefferson County, Ala.	[8]4.3	[4]46.0	[4]1,050	[3]17,500
					Alabama River Basin						
16	Robert F. Henry Lock and Dam	[4]Jones Bluff Lake	Alabama River	USACOE	1971	P, N, R	Lowndes County, Ala.	[6]245.4	[4]16,300	[4]12,510	[4]234,200
17	Millers Ferry Lock, Dam, and Powerhouse	William “Bill” Dannelly Lake	Alabama River	USACOE	1970	P, N, R	Wilcox County, Ala.	[6]142.3	[4]20,700	[4]17,200	[4]331,800
18	Claiborne Lock and Dam	Claiborne Lake	Alabama River	--	1969	N	Monroe County, Ala.	[6]81.8	[6]21,473	[4]5,930	[4]96,360
					Black Warrior Subbasin						
19	John Hollis Bankhead Lock and Dam	Lake Bank-head	Black Warrior River	APC	1928 (1975)	N	Jefferson County, Ala.	[2]153.6	[2]3,981	[4]9,200	112,000 (usable capacity) [4]288,000
20	Holt Lock and Dam	Holt Lake	Black Warrior River	USACOE	1976	N	Tuscaloosa County, Ala.	[2]135.1	[2]4,219	[4]3,296	115,000 (usable capacity)
21	William Bacon Oliver Lock and Dam	William Bacon Oliver Lake	Black Warrior River	USACOE	[4]1940	N	Tuscaloosa County, Ala.	[2]125.9	[2]4,820	[4]2,220	[4]12,500
22	Selden Lock and Dam	Warrior Lake	Black Warrior River	USACOE	1946	N	Hale County, Ala.	[2]49.6	[2]5,810	[4]7,800	[4]54,000
23	Lewis Smith	Lewis Smith Reservoir	Sipsey Fork River	APC	1960	P, FC	Walker County, Ala.	[2]13.5	[2]945	[4]21,000	394,000
24	Lake Tusca-loosa Dam	Lake Tuscaloosa	Black Warrior River	City of Tusca-loosa	1971	WS, FC, R	Tuscaloosa County, Ala.	--	[2]416	[4]5,885	[4]130,000
					Tombigbee River Basin						
25	Aberdeen Lock and Dam	Aberdeen Lake	Tombigbee River	USACOE	1981	N	Monroe County, Miss.	[6]363.0	[4]2,170 [6]2,047	[4]4,121	[4]31,564
26	Whitten Lock and Dam	Bay Springs Lake	Tombigbee River	USACOE	1985	N	Tisho-mingo County, Miss.	--	[4]68.2	[4]6,700	[4]180,000

Table 3. Dams and associated impoundments in the Mobile River Basin—Continued

No. (see fig. 8)	Name of dam	Associated impound-ment	River	Agency	Date constructed or operational	Princi-pal use	Location	River mile	Total drainage area (mi^2)	Full power or normal pool data	
										Surface area (acres)	Storage capacity (acre-feet)
					Tombigbee River Basin—Continued						
27	Stennis Lock and Dam	Columbus Lake	Tombigbee River	USACOE	1978	N	Lowndes County, Miss.	[6]325.3	[4]4,440	[4]8,910	[4]59,483
28	Amory Lock	Lock “A” Pool	Tombigbee River	USACOE	1981	N	Monroe County, Miss.	--	--	[7]914	--
29	Glover Wilkins Lock	Lock “B” Pool	Tombigbee River	USACOE	1981	N	Monroe County, Miss.	--	[4]1,226	[4]2,718	[4]19,039
30	Fulton Lock	Lock “C” Pool	Tombigbee River	USACOE	1981	N	Lowndes County, Miss.	--	--	[4]1,642	[4]13,221
31	John Rankin Lock	Lock “D” Pool	Tombigbee River	USACOE	1985	N	Itawamba County, Miss.	--	--	[4]1,992	[4]24,869
32	G.V. “Sonny” Montgom-ery Lock	Lock “E” Pool	Tombigbee River	USACOE	1985	N	Itawamba County, Miss.	--	--	[4]851	[4]6,926
33	Tom Belville Lock and Dam	Aliceville Lake	Tombigbee River	USACOE	1979	N, R	Pickens County, Ala.	[6]287.4	[4]5,750	[4]8,300	[4]60,400
34	John C. Heflin Lock and Dam	Gainesville Lake	Tombigbee River	USACOE	1978	N, R	Greene County, Ala.	[6]238.8	[4]7,220	[4]6,400	[4]45,290
35	Demopolis Lock and Dam	Demopolis Lake	Tombigbee River	USACOE	1928 ([4]1955)	N	Marengo County, Ala.	[2]171.2	[2]15,385	[4]1,000	[4]150,000
36	Coffeville Lock and Dam	Coffeville Lake	Tombigbee River	USACOE	1960 ([4]1962)	N	Choctaw County, Ala.	[2]74.7	[2]18,417	8,500	[4]190,800

[1] Stokes and McFarlane (1994)
[2] Pearman and others (1997)
[3] Strickland (1994)
[4] Ruddy and Hitt (1990)
[5] U.S. Army Corps of Engineers (1985b)
[6] U.S. Army Corps of Engineers (1985a)
[7] The Tennessee Tombigbee Waterway Development Authority (2001)
[8] Rollins and others (1987)

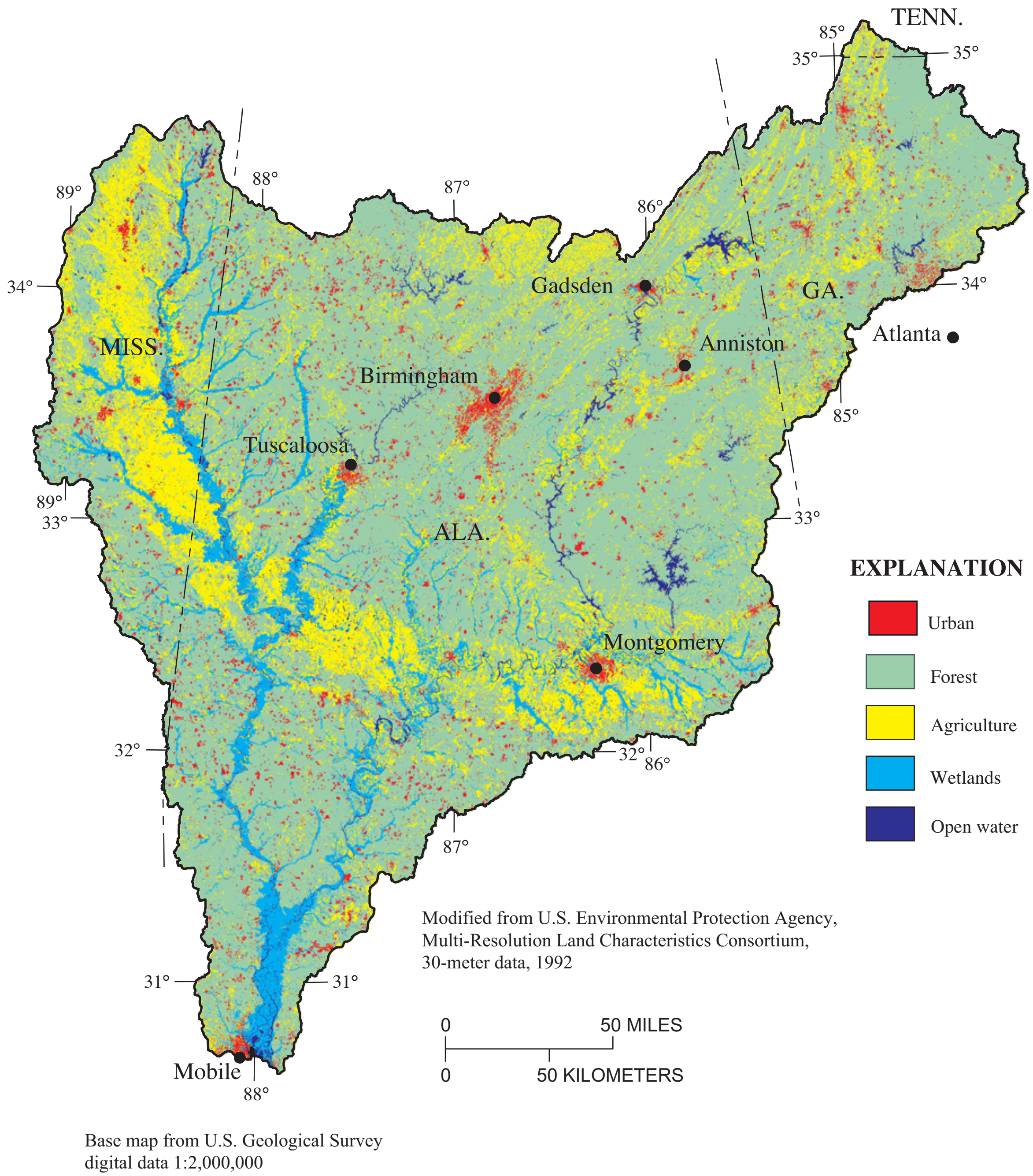


Figure 15. Land use in the Mobile River Basin.

Line Hills districts (figs. 16 and 17). Soybeans cover the greatest acreage and is almost as well distributed as corn with the greatest concentrations in Mississippi. Cotton is the second highest acreage crop and is concentrated in selected areas in the Valley and Ridge and Cumberland Plateau Physiographic Provinces and in the Coastal Plain Physiographic Province (Fall Line Hills district, Black Prairie Belt district, Southern Hills district, and Alluvial aquifer). The greatest acreage of wheat is concentrated in selected areas in the Southern Hills district, Black Prairie Belt district, and the Alluvial aquifer of the Coastal Plain Physiographic Province. Sorghum acreage is not as prevalent as other crops but is evenly distributed across the basin, except in the Blue Ridge Physiographic Province and in Deltaic deposits where no sorghum is produced (U.S. Department of Agriculture, National Agricultural Statistics Service, 1997).

Livestock production in the Mobile River Basin includes poultry, cattle, and swine. The greatest density of swine production is in the Cumberland Plateau Physiographic Province (figs. 18 and 19). Poultry operations are concentrated in the northern part of the Mobile River Basin in Alabama and Georgia. Chicken production is greatest throughout the Blue Ridge and Cumberland Plateau Physiographic Provinces but also is prevalent in the Valley and Ridge and the Piedmont Physiographic Provinces. Broilers by far comprise the largest chicken operations. Cattle production is ubiquitous with the highest density of production in the Blue Ridge, Cumberland Plateau, and Valley and Ridge Physiographic Provinces. Few large cattle feedlots operate in the Mobile River Basin, and the majority of cattle are raised for beef on pastureland (U.S. Department of Agriculture, National Agricultural Statistics Service, 1997).

Urban

The total population for the Mobile River Basin was about 3,673,100 people in 1990 based on estimates of county population (U.S. Bureau of the Census, 2001). Urban areas account for only 3 percent of the total land use; however, the areal extent of the MSAs may indicate more urban influences. The MSAs include urban areas outside metropolitan boundaries and can include adjacent counties. Seven MSAs are delineated in the Mobile River Basin and include Montgomery, Mobile, Tuscaloosa, Birmingham, Gadsden, Anniston, and Atlanta (fig. 20). The cities with their entire MSAs included in the study area are Birmingham with a 1990 population of 839,942; Montgomery, 292,517; Tuscaloosa, 150,522; Anniston, 116,032; and Gadsden, 99,840 people (U.S. Bureau of the Census, 1998). Anniston lies entirely within the Valley and Ridge Physiographic Province whereas Birmingham and Gadsden lie mostly within the Valley and Ridge Physiographic Province with some area in the Cumberland Plateau Physiographic Province. Montgomery and Tuscaloosa lie mostly within the Alluvial aquifer of the Coastal Plain Physiographic Province, and Mobile lies mostly within the Southern Hills district of the Coastal Plain Physiographic Province. Part of the Atlanta MSA lies in the Piedmont Physiographic Province of the Mobile River Basin. The most concentrated areas of population lie within the Valley and Ridge and Cumberland Plateau Physiographic Provinces in Alabama and the Piedmont Physiographic Province in Georgia. The Blue Ridge Physiographic Province has the lowest overall population density but has the highest rate of growth, reflecting a 62-percent increase in population from 1970 to 1990 (table 4). The Piedmont Physiographic Province experienced a 60-percent growth from 1970 to 1990, resulting from urban sprawl in the Atlanta area. The Mobile River Basin experienced an overall growth of 23 percent for the same time period.

The population in urban areas is increasing faster than in rural areas, resulting in increasing water-quality concerns. Urban and residential areas can affect the quality and quantity of water resources by altering the physical hydrology and by adding waste products to water bodies. As urbanization increases, the amount of impervious area increases, thus decreasing the amount of water that would naturally infiltrate into the soil. Increased runoff can alter the magnitude and timing of storm peaks, increasing the likelihood of localized flooding. Urban runoff also can transport large nonpoint-source loads of sediment and inorganic and organic constituents from paved surfaces, parks, lawns, and golf courses. Point sources of contamination from urban areas can include sewage-treatment facilities, industrial discharges, landfills, and leaking underground storage tanks.

Nonpoint-source contamination in urban areas is a common contributor to water body impairment. Although associated with agricultural activities, pesticides and fertilizers are applied to urban land at greater rates per unit area than typically applied to agricultural land, thus contributing to water-quality impairment. Lawns, gardens, parks, and golf courses are subject to intense pesticide application. Insecticides used largely